

WHAT IS CLAIMED IS:

- 1 1. A method for processing ingress data by an edge device of a transport
2 network, the method comprising:
 - 3 a) determining a first label and a second label based on layer 2
4 destination information of the ingress data;
 - 5 b) adding the first and second labels to the data to generate modified
6 data; and
 - 7 c) using the first label to forward the modified data towards an egress
8 edge device of the transport network
9 wherein the second label is to be used by the egress edge device
10 to associate the ingress data with a destination device and a channel.
- 1 2. The method of claim 1 further comprising:
2 a1) removing the destination information of the ingress data.
- 1 3. The method of claim 1 further comprising:
2 b1) encapsulating the modified data.
- 1 4. The method of claim 1 wherein the destination information of the ingress data
2 is represented by a logical identifier.
- 1 5. The method of claim 4 wherein the logical identifier is associated with a
2 unique virtual private network.
- 1 6. The method of claim 5 wherein the logical identifier and the virtual private
2 network are used to determine the egress edge device associated with the first
3 label.

1 7. The method of claim 5 wherein the logical identifier and the virtual private
2 network are used to determined the destination device and channel associated
3 with the second label.

1 8. The method of claim 7 wherein the second label and the advertisement of the
2 egress edge device are used to determine the channel to the destination device.

1 9. A method for processing egress data, having a first label and a second label,
2 by an edge device of a transport network, the method comprising:
3 a) determining a channel to a destination customer edge device based on
4 the second label;
5 b) forwarding the egress data on the channel determined.

1 10. The method of claim 9 wherein the second label was derived from an
2 identifier of the destination customer edge device, and a label base of a source
3 customer edge device.

1 11. The method of claim 10 wherein the second label was mapped from a
2 channel identifier for the destination customer edge device used by the source
3 customer edge device.

1 12. The method of claim 11 wherein the channel identifiers for the destination
2 customer devices used by the source customer edge device and the destination
3 customer edge device may be different.

1 13. A method for generating, by a transport network edge device, information
2 about a newly added customer edge device belonging to a virtual private
3 network, to be disseminated to other edge devices of the transport network, the
4 method comprising:
5 a) obtaining a label base value and a range value associated with the
6 newly added customer edge device;

7 b) generating at least one message, the at least one message collectively
8 including

- 9 i) a first field for identifying the transport network edge device;
10 ii) a second field for identifying the virtual private network to which
11 the newly added customer edge device belongs;
12 iii) a third field for identifying the newly added customer edge
13 device;
14 iv) a fourth field for identifying the range value; and
15 v) a fifth field for identifying the label base.

1 14. The method of claim 13 further comprising:

- 2 - defining a set of labels based on the label base value and the range
3 value.

1 15. The method of claim 14 wherein the set of labels is contiguous.

1 16. The method of claim 13 wherein a value in the third field for identifying the
2 newly added customer edge device is unique within the virtual private network
3 identified in the second field.

1 17. The method of claim 13 further comprising:

- 2 c) sending the message towards other edge devices of the transport
3 network.

1 18. The method of claim 17 wherein the message is sent using a label
2 distribution protocol.

1 19. The method of claim 17 wherein the message is sent using a border
2 gateway protocol.

1 20. The method of claim 13 wherein the at least one message further includes

vi) a sixth field for defining an encapsulation type used by the newly added customer edge device.

21. The method of claim 13 wherein the range value the newly added customer edge device corresponds to a number of elements in a list of channel identifiers provisioned at the newly added customer edge device.

22. A method for processing, by a first transport network edge device, information about a newly added customer edge device belonging to a virtual private network, the method comprising:

- for a second customer edge device, belonging to the virtual private network and attached to the first transport network edge device,
 - a) determining a first label for getting to a second transport network edge device sourcing the information about the newly added customer edge device,
 - b) determining a second label for reaching the newly added customer edge device from the second transport network device,
 - c) determining a third label for data from the newly added customer edge device to reach the second customer edge device from the first transport network edge device,
 - d) determining a first route mapping an identifier of the newly added customer edge device, used by the second customer edge device, to the first label and the second label, and
 - e) determining a second route mapping the third label to a channel identifier of the second customer edge device.

23. The method of claim 22 wherein the information about a newly added customer edge device belonging to a virtual private network includes:

- a first value identifying the second transport network edge device;
- a second value identifying the virtual private network;
- a third value identifying the newly added customer edge device;

- 6 - a fourth value identifying a range associated with the newly added
- 7 customer edge device; and
- 8 - a fifth value identifying a label base associated with the newly added
- 9 customer edge device.

1 24. The method of claim 22 wherein the act of determining a first label for getting
2 to the second transport network edge device is based on a label distribution
3 protocol.

1 25. The method of claim 24 wherein the label distribution protocol is a protocol
2 selected from a group consisting of (A) RSVP-TE, (B) LDP, and (CR-LDP).

1 26. The method of claim 22 wherein the act of determining a second label for
2 reaching the newly added customer edge device from the second transport
3 network edge device includes determining a function of a label base of the newly
4 added customer edge device and a value derived from an identifier of the second
5 customer edge device.

1 27. The method of claim 22 wherein the act of determining a third label for data
2 from the newly added customer edge device to reach the second customer edge
3 device includes determining a function of a label base of the second customer
4 edge device and a value derived from the identifier of the newly added customer
5 edge device.

1 28. The method of claim 22 wherein the range associated with the newly added
2 customer edge device corresponds to a number of elements in a list of channel
3 identifiers provisioned at the newly added customer edge device.

1 29. The method of claim 22 further comprising determining whether an
2 encapsulation type used by the second customer edge device is compatible with
3 that used by the newly added customer edge device.

1 30. The method of claim 22 further comprising determining whether any address
2 conflicts exist within the virtual private network based on the second customer
3 edge device and the newly added customer edge device.

1 31. The method of claim 22 further comprising determining whether the second
2 customer edge device has sufficient unused channel identifiers to accommodate
3 the newly added customer edge device.

1 32. A device for use at the edge of a layer 2 transport network, the device
2 comprising:

3 a) a storage facility for storing

4 i) a first route mapping a channel identifier corresponding to a
5 destination customer edge device to a first label for forwarding data
6 to a proper egress service provider edge device and a second label
7 for forwarding data from the proper egress service provider edge
8 device to the destination customer edge device, and

9 ii) a second route mapping an ingress second label to a channel
10 identifier associated with a destination customer edge device; and

11 b) a forwarding facility for

12 i) forwarding ingress data to an egress service provider edge
13 device based on the first route, and

14 ii) forwarding egress data to a destination customer edge device
15 based on the second route.

1 33. The device of claim 32 further comprising:

2 c) a configuration facility for determining the first and second routes
3 stored in the storage facility based on received advertisements about
4 newly added customer edge devices.

1 34. The device of claim 32 further comprising:

- 2 c) a signaling facility for signaling information about a newly added
3 customer edge device coupled with the device, to other devices at the
4 edge of the layer 2 transport network.

1 35. The device of claim 34 where the information about a newly added customer
2 edge device includes:

- 3 - a first value identifying the device;
4 - a second value identifying a virtual private network to which the newly
5 added customer edge device belongs;
6 - a third value identifying the newly added customer edge device;
7 - a fourth value identifying a range associated with the newly added
8 customer edge device; and
9 - a fifth value identifying a label base associated with the newly added
10 customer edge device.

1 36. The device of claim 35 wherein the range associated with the newly added
2 customer edge device corresponds to a number of elements in a list of channel
3 identifiers provisioned at the newly added customer edge device.

1 37. A layer 2 transport network for use by a source customer edge device and a
2 destination customer edge device, both belonging to a same virtual private
3 network, the source customer edge device having a list of channel identifiers for
4 each customer edge device of the virtual private network, the layer 2 network
5 comprising:

- 6 a) a first transport network edge device, the first transport network edge
7 device coupled with the source customer edge device and having
8 i) a storage facility for storing a first route mapping a first channel
9 identifier, used by the source customer edge device and
10 corresponding to the destination customer edge device, to a first
11 label for forwarding data to a second transport network edge device

12 and a second label associated with the destination customer edge
13 device, and
14 ii) a forwarding facility for forwarding data addressed to the
15 destination customer edge device to the second transport network
16 edge device based on the first label of the first route; and
17 b) the second transport network edge device, the second transport
18 network edge device coupled with the destination edge device and having
19 i) a storage facility for storing a second route mapping the second
20 label to a second channel identifier associated with the destination
21 customer edge device; and
22 ii) a forwarding facility for forwarding the data to the destination
23 customer edge device based on the second channel identifier of the
24 second route.

1 38. The layer 2 transport network of claim 37 wherein each of the first channel
2 identifier and the second channel identifier is associated with the destination
3 customer edge device, and
4 wherein the first channel identifier may be different from the second
5 channel identifier.

1 39. In an edge device of a service provider transport network, a
2 machine-readable medium having stored thereon a data structure, the data
3 structure comprising:
4 a) a first list of virtual private networks supported by the service provider
5 transport network;
6 b) for each of the virtual private networks of the list, a second list of
7 customer edge devices belonging to the virtual private network;
8 c) for each of the customer edge devices of the second list,
9 i) a first field for storing a label base, and
10 ii) a second field for storing a range.

1 40. The machine-readable medium of claim 39 further comprising a third field for
2 storing an encapsulation type for each of the customer edge devices of the
3 second list.

1 41. The machine-readable medium of claim 39 wherein the range corresponds
2 to a number of elements in a list of channel identifiers provisioned at the
3 customer edge device.

1 42. In an edge device of a service provider transport network, a
2 machine-readable medium having stored thereon a data structure, the data
3 structure comprising:

- 4 a) a first list of virtual private networks supported by the service provider
5 transport network;
- 6 b) for each of the virtual private networks of the list, a second list of
7 customer edge devices belonging to the virtual private network;
- 8 c) for each of the customer edge devices of the second list, a third list of
9 channel identifiers.

1 43. The machine-readable medium of claim 42 further comprising:

- 2 d) for each of the channel identifiers of the third list,
 - 3 i) first route mapping a channel identifier to a first label for
4 forwarding ingress data to a proper egress service provider edge
5 device and a second label for forwarding ingress data from the
6 proper egress service provider edge device to a destination
7 customer edge device, and
 - 8 ii) a second route mapping a second label of egress data to a
9 channel identifier associated with a destination customer edge
10 device.

1 44. A machine-readable medium having stored thereon a message data
2 structure, the message data structure comprising:

- a) a first field identifying a transport network edge device which sourced the message data structure;
- b) a second field identifying a virtual private network to which a given customer edge device, connected with the transport network edge device, belongs;
- c) a third field identifying the given customer edge device;
- d) a fourth field identifying a range associated with the given customer edge device; and
- e) a fifth field identifying a label base associated with the given customer edge device.

45. The machine-readable medium of claim 44 wherein the message data structure is used to advertise information about the given customer edge device to other edge devices of a layer-2 transport network.

46. The machine-readable medium of claim 44 wherein the range associated with the given customer edge device corresponds to a number of elements in a list of channel identifiers provisioned at the given customer edge device.

47. A device for use at the edge of a layer 2 transport network, the device comprising:

- a) a storage facility for storing a route mapping a channel identifier corresponding to a destination customer edge device to a label for forwarding data to a proper egress service provider edge device and a second label for forwarding data from the proper egress service provider edge device to the destination customer edge device; and
- b) a forwarding facility for forwarding ingress data to an egress service provider edge device based on the route.

48. A device for use at the edge of a layer 2 transport network, the device comprising:

- 3 a) a storage facility for storing a route mapping an ingress label to a
- 4 channel identifier associated with a destination customer edge device; and
- 5 b) a forwarding facility for forwarding egress data to a destination
- 6 customer edge device based on the route.